

DEPARTMENT OF GRAIN SCIENCE AND INDUSTRY

Corn Grading Procedures

Definition of corn

Grain that consists of 50 percent or more of whole kernels of shelled dent corn and/or shelled flint corn (*Zea mays L.*) and not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.

Definition of other terms**(a) Broken corn.**

All matter that passes readily through a 12/64 round-hole sieve and over a 6/64 round-hole sieve according to procedures prescribed in FGIS instructions.

(b) Broken corn and foreign material.

All matter that passes readily through a 12/64 round-hole sieve and all matter other than corn that remains in the sieved sample after sieving according to procedures prescribed in FGIS instructions.

(c) Classes.

There are three classes for corn: Yellow corn, White corn, and Mixed corn.

(1) **Yellow corn.** Corn that is yellow-kerneled and contains not more than 5.0 percent of corn of other colors. Yellow kernels of corn with a slight tinge of red are considered Yellow corn.

(2) **White corn.** Corn that is white-kerneled and contains not more than 2.0 percent of corn of other colors. White kernels of corn with a slight tinge of light straw or pink color are considered White corn.

(3) **Mixed corn.** Corn that does not meet the color requirements for either of the classes Yellow corn or White corn and includes white-capped Yellow corn.

(d) Damaged kernels.

Kernels and pieces of corn kernels that are badly ground-damaged, badly weather-damaged, diseased, frost-damaged, germ-

Timothy J. Herrman
Extension State Leader
Grain Science and Industry

Carl Reed
Extension Specialist, Grain Storage
Grain Science and Industry

damaged, heat-damaged, insect-bored, mold-damaged, sprout-damaged, or otherwise materially damaged.

(e) Foreign material. All matter that passes readily through a 6/64 round-hole sieve and all matter other than corn that remains on top of the 12/64 round-hole sieve after sieving according to procedures prescribed in FGIS instructions.

(f) Heat-damaged kernels.

Kernels and pieces of corn kernels

that are materially discolored and damaged by heat.

(g) Sieves.

(1) **12/64 round-hole sieve.** A metal sieve 0.032 inch thick with round perforations 0.1875 (12/64) inch in diameter that are 1/4 inch from center to center. The perforations of each row shall be staggered in relation to the adjacent row.

(2) **6/64 round-hole sieve.** A metal sieve 0.032 inch thick with round perforations 0.0937 (6/64) inch in diameter that are 5/32 inch from center to center. The perforations of each row shall be staggered in relation to the adjacent row.

Principles Governing the Application of Standards

Basis of determining

Each determination of class, damaged kernels, heat-damaged kernels, waxy corn, flint corn, and flint and dent corn is made on the basis of the grain after the removal of the broken corn and foreign material. Other determinations not specifically provided for under the General Provisions are made on the basis of the grain as a whole, except the determination of odor is made on either the basis of the grain as a whole or the grain when free from broken corn and foreign material.

Special grades and special grade requirements

- (a) **Flint corn.** Corn that consists of 95 percent or more of flint corn.
- (b) **Flint and dent corn.** Corn that consists of a mixture of flint and dent corn containing more than 5.0 percent but less than 95 percent of flint corn.
- (c) **Infested corn.** Corn that is infested with 2 or more live weevils, 1 live weevil and 5 other live insects injurious to stored grain or 10 live insects injurious to stored grain.
- (d) **Waxy corn.** Corn that consists of 95 percent or more waxy corn according to procedures prescribed in FGIS instructions.

Grade corn as follows:

- Step 1. Examine the sample for heating, odor, animal filth, castor beans, crotalaria seeds, glass, insect infestation, stones, unknown foreign substances, and other unusual conditions.
- Step 2. Divide out a representative portion from the sample and determine its moisture content.
- Step 3. Determine the test weight per bushel of the sample.
- Step 4. Determine the percentage of broken corn and foreign material (BCFM) in the sample.
- Step 5. When deemed necessary, divide out representative portions from the BCFM-free sample and determine the percentage of class, damaged kernels, flint corn, flint and dent corn, heat-damaged kernels, and waxy corn.

Portion Sizes

The recommended minimum portion size is as follows:

Damaged kernels	125 grams
Dockage	NA
Foreign material	250 grams
Heating	The lot as a whole.
Infestation	The original sample or lot as a whole.
Moisture	The amount recommended by the instrument manufacturer.
Objectionable odors	The original sample or lot as a whole.
Test weight per bushel	An amount sufficient to cause grain to overflow a kettle.

Test Weight per Bushel

Test weight per bushel is the weight of the volume of grain that is required to fill a Winchester bushel (2,150.42 cubic inch) to capacity. Since test weight per bushel tends to increase as moisture content decreases, determine it as quickly as possible after the grain is sampled.

Determine test weight per bushel before the removal of BCFM.

Several devices may be used to determine test weight per bushel; all of these devices operate in a similar manner.

Step 1. Pour the sample through a funnel into a kettle until the grain overflows the kettle.

Step 2. After pouring the grain into the kettle, level it off by making three, full-length, zigzag motions with a stroker.

Step 3. Then weigh the filled kettle on either (1) a special beam scale attached to the funnel stand, (2) an electronic scale programmed to convert gram weight to test weight per bushel, or (3) a standard laboratory scale. If a standard laboratory scale is used, the gram weight must be manually converted to test weight per bushel by using a special conversion chart. This will be recorded on the work record and the certificate to the nearest tenth pound per bushel. For example, 54.32 will be recorded as 54.3.

Procedures for Determining Foreign Material and Broken Corn (BCFM) with Hand Sieves

Step 1. Nest the appropriate sieve(s) on top of a bottom pan. Use a 12/64-inch round-hole sieve.

Step 2. Pour a sample portion (250 grams) into the center of the top sieve.

Step 3. Place the sieve(s) in a mechanical grain sizer, set the sizer's timer to 20, and turn it on.

If a mechanical sizer is not available, hold the sieves and bottom pan level, and, using a steady motion, move the sieve from right to left approximately 10 inches. Return from left to right to complete one sieving operation. Repeat this operation 20 times.

Step 4. Consider BCFM to be all material that passed through the 12/64-inch round-hole sieve and all material — other than corn — that remains on top of the sieve.

Corn

Table No. 1 - Grades and Grade Requirements

Grading Factors	Grades U.S. Nos.				
	1	2	3	4	5
<i>Minimum Pound Limits of</i>					
Test Weight (pounds per bushel)	56.0	54.0	52.0	49.0	46.0
<i>Maximum Percent Limits of:</i>					
Damaged kernels					
Heat	0.1	0.2	0.5	1.0	3.0
Total	3.0	5.0	7.0	10.0	15.0
Broken corn and foreign material	2.0	3.0	4.0	5.0	7.0

U.S. Sample grade

U.S. Sample grade is corn that:

- (a) Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, or 5; or
- (b) Contains stones that have an aggregate weight in excess of 0.10 percent of the sample weight, 2 or more pieces of glass, 3 or more crotalaria seeds (*Crotalaria* spp.), 2 or more castor beans (*Ricinus communis* L.), 4 or more particles of an unknown foreign substance(s) or a commonly recognized harmful or toxic substance(s), 8 or more cockleburs (*Xanthium* spp.) or similar seeds singly or in combination, or animal filth in excess of 0.20 percent in 1000 grams; or
- (c) Has a musty, sour, or commercially objectionable foreign odor; or
- (d) Is heating or of distinctly low quality.

Blue Eye Mold Damage

A germ affected with blue eye mold (regardless of size of the mold), is a damaged kernel. If mold is distinct, it is not necessary to open or scrape kernel. If opening is necessary, lift germ cover carefully to avoid destroying evidence of mold.

Note: Do not confuse blue eye mold with purple plumules.

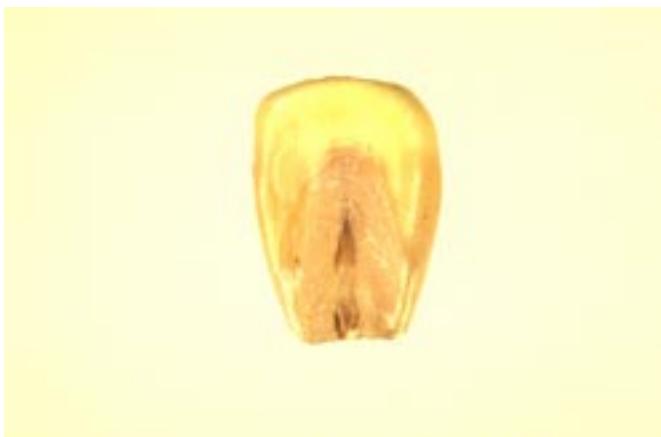


Germ Damage

Kernels of corn that have been damaged by respiration or heat, but that are not materially discolored, shall be considered damaged. See procedure for details and interpretation guidelines.

Procedure:

1. Those kernels requiring close examination should be carefully opened so as to remove only the seed coat over the germ area. Scraping too deeply can destroy the evidence of damage and cause non-uniformity of interpretation.
2. Kernels should be opened with a sharp instrument, such as a pair of picks or a knife.
3. Observe the entire germ area when determining if the kernel is dark or darker than the kernel shown on the slide.
4. Germs that have more intense partial discoloration require less coverage of the germ area in order to be considered damaged.



Heat Damage (Yellow) Materially Discolored by Heat

Kernels that are materially discolored by excessive respiration, with the discoloration extending out of the germ, around the sides and across the back of the kernel.

Kernel 1: Shows the discoloration extending out of the germ.

Kernel 2: Shows the discoloration around the sides.

Kernel 3: Shows the discoloration across the back.

Note: Kernels that meet these conditions are considered heat damage. For heat damage (dryer) and heat damage in white corn refer to Interpretative Line Slide C-5.0 and C-5.1 respectively.



Insect Damage

Kernels with obvious weevil-bored holes or that have evidence of boring or tunneling (tracings) indicating the possible inner presence of insects, insect webbing or insect refuse.



Mold Damage

Whole or broken kernels that contain any amount of mold on the exposed part of the kernel are considered damaged.

Note: Do not confuse mold with dirt. Mold occurs in many colors.



Pictures and descriptions of kernel damage were reproduced from the interpretive line slides with the permission of Seedburo Equipment Company.

Publications from Kansas State University are available on the World Wide Web at: <http://www.oznet.ksu.edu>

Text in this publication was compiled from United States Department of Agriculture publication *Official United States Standards for Grain and Inspecting Grain, Practical Procedures for Grain Handlers*.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

EP-96

December 2000

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.